Environment for Reverberation Workshop Problems
6 April 06

Isovelocity Environment

3-D problems: 100 m deep waveguide. 1500 m/s sound speed. Thorp attenuation. Sand halfspace. 1700 m/s sound speed. Density 2.0 gm/cm^3. Loss 0.5 dB/λ.

The "Thorp" attenuation in the water column will be taken as given by Eq. (1.34) on page 38 in *Computational Ocean Acoustics* by Jensen, Kuperman, Porter, and Schmidt. See pages 35-38 for the corresponding plane wave attenuation α.

The sediment attenuation is 0.5 dB/λ, where λ is the wavelength in the sediment. The corresponding ratio of the imaginary/real wavenumber components in the sediment is 0.009162. See Scattering_models5.doc for further discussion.

2-D problems: 50 m deep waveguide. All other parameters as for the 3-D problems.

Summer Environment

3-D problems: 100 m deep waveguide. 1530 m/s sound speed at surface. Downward refracting linear gradient 0.30 s^{-1}. Thorp attenuation. Sand halfspace. 1700 m/s sound speed. Density 2.0 gm/cm^3. Loss 0.5 dB/λ.

2-D problems: 50 m deep waveguide. 1515 m/s sound speed at surface. Downward refracting linear gradient 0.30 s^{-1}. All other parameters as for the 3-D problems.

Winter Environment

3-D problems: 100 m deep waveguide. 1500 m/s sound speed at bottom. Upward refracting gradient 0.10 s^{-1}. 1490 m/s sound speed at surface. Thorp attenuation. Sand halfspace. 1700 m/s sound speed. Density 2.0 gm/cm^3. Loss 0.5 dB/λ.

2-D problems: 50 m deep waveguide. 1500 m/s sound speed at bottom. Upward refracting gradient 0.10 s^{-1}. 1495 m/s sound speed at surface. All other parameters as for the 3-D problems.

Range-Dependent Environment I

3-D problems: 200 m deep range-independent half plane to the west with wedge half plane to the east. The wedge depth becomes zero at a range of 7.393 km to the east (1.55^o slope).

2-D problems: 50 m deep range-independent half plane to the west with wedge half plane to the east. The wedge depth becomes zero at a range of 7.393 km to the east (0.3875^o slope).

Range-Dependent Environment II (Problem XX, “Harrison Napoleon Hat)

30 m deep range-independent half plane to the east with deepening wedge to the west. The wedge depth becomes 130 m at a range of 10 km to the west (0.57^{o} slope).

Source-Receiver Geometry

3-D problems: 30 m source depth (5 km to the west in Bistatic Problems). 10, 50 and 90 m receiver depth (5 km to the east at same latitude for Bistatic Problems, buried receiver neglected for range dependent bistatic problem).

Problem XX: 15 m source 10 km to the east. 10, 50 and 90 m receivers 10 km to the west.

2-D problems: 15 m source depth. 5, 25 and 45 m receiver depths.

Horizontal Directivity

3D Monostatic Range Independent.	None.
3D Bistatic Range Independent.	75 λ HLA oriented North-South
3D Monostatic Range Dependent.	75 λ HLA oriented North-South
3D Bistatic Range Dependent.	75 λ HLA oriented North-South

In all directive cases: total left-right ambiguity rejection and Hanning weights.

Environmental Scatterers

2D Roughness Spectra (for 3D problems)

“Rough” Bottom Roughness: Isotropic with 2D wavenumber spectrum of the form

$$P(K_x,K_y)=\frac{h^2 l^2}{2\pi(1+K_x^2 l^2+K_y^2 l^2)^{3/2}}$$

with rms height h = 0.141 m and l = 10 m. See Scattering_models5.doc for further discussion.

“Typical” Sandy Bottom Roughness: Isotropic with 2D wavenumber spectrum as above and with rms height h = 0.316 m and l = 400 m.

Surface Roughness: Isotropic Pierson-Moskowitz wavenumber spectrum for a wind speed of 10 m/s. See Scattering_models5.doc for detailed description.

1D Roughness Spectra for 2D problems (Problems I, II, III, and IV)

1D roughness spectra have been obtained such that 1D roughness realizations are equivalent to 1D slices through the corresponding 2D realizations. However, for the surface case, the 2D Pierson-Moskowitz spectrum has been approximated near the low wavenumber cutoff region to simplify the 1D roughness spectrum. See Scattering_models5.doc for detailed descriptions.

Lambert's Law

Laterally isotropic with –27 dB coefficient.